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First Named Inventor:

Daniel Joseph Melchione

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UTILITY PATENT APPLICATION TRANSMITTAL (37 CFR § 1.53(b))

Assistant Commissioner for Patents
Box Patent Application
Washington, DC 20231

Duplicate for fee processing

Sir: This is a request for filing a patent application under 37 CFR § 1.53(b) in the name of inventors: Daniel Joseph Melchione

FOR: SYSTEM, METHOD AND COMPUTER PROGRAM PRODUCT FOR PROCESS-BASED SELECTION OF VIRUS DETECTION ACTIONS

Application Elements:

- 20 Pages of Specification, Claims and Abstract
4 Sheets of Drawings
2 Pages Combined Declaration and Power of Attorney

Accompanying Application Parts:

- Assignment and Assignment Recordation Cover Sheet (recording fee of \$40.00 enclosed)
37 CFR 3.73(b) Statement by Assignee
Information Disclosure Statement with Form PTO-1449
Copies of IDS Citations
Preliminary Amendment
Return Receipt Postcard
Small Entity Statement(s)
Other:

Fee Calculation (37 CFR § 1.16)

Table with 6 columns: (Col. 1) NO. FILED, (Col. 2) NO. EXTRA, SMALL ENTITY RATE, OR, LARGE ENTITY RATE, FEE. Rows include BASIC FEE, TOTAL CLAIMS, INDEP CLAIMS, Multiple Dependent Claim Presented, and Total fee of \$864.

☒ Check No. 120 in the amount of \$904.00 is enclosed.

☒ The Commissioner is authorized to charge any fees beyond the amount enclosed which may be required, or to credit any overpayment, to Deposit Account No. 50-1351 (Order No. NAI1P004/00.006.01).

General Authorization for Petition for Extension of Time (37 CFR §1.136)

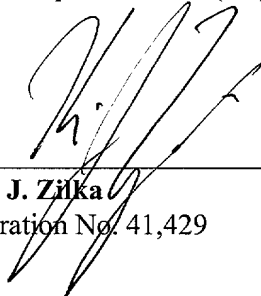
☒ Applicants hereby make and generally authorize any Petitions for Extensions of Time as may be needed for any subsequent filings. The Commissioner is also authorized to charge any extension fees under 37 CFR §1.17 as may be needed to Deposit Account No. 50-1351 (Order No. NAI1P004/00.006.01).

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DOCKET No.

NAI1P004/00.006.01

U.S. PATENT APPLICATION
FOR
SYSTEM, METHOD AND COMPUTER
PROGRAM PRODUCT FOR PROCESS-BASED
SELECTION OF VIRUS DETECTION
ACTIONS

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001650-138550

SYSTEM, METHOD AND COMPUTER PROGRAM PRODUCT FOR PROCESS-BASED SELECTION OF VIRUS DETECTION ACTIONS

Daniel Joseph Melchione

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RELATED APPLICATION

The present application is related to an application filed concurrently
10 herewith under the title "System, Method and Computer Program Product for
Selecting Virus Detection Actions based on a Process by which Files are being
Accessed" and attorney docket number NAI1P003/00.069.01, and which is
incorporated herein by reference in its entirety.

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FIELD OF THE INVENTION

The present invention relates to virus detection methods, and more particularly to
executing virus detection methods in a manner that ensures the efficient utilization of
system resources.

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BACKGROUND OF THE INVENTION

Virus scanners traditionally provide off-access virus scanning, e.g., a file is
scanned when it is not in use. Typically scanning is performed at an off-peak time,
25 such as during the night, when it is most likely that all files will be available for
review by the scanning software. Unfortunately, the advent of fast Internet
connection, and the proliferation of computers in the workplace and home, allows
the users to obtain and share files much faster than the traditional virus scanners can
scan and correct viruses. Consequently, off-peak scanning services are no longer
30 sufficient.

To compensate, on-access scanning has been developed. In on-access scanning, as the name suggests, a file is scanned when access is attempted to the file. This scanning may be performed along with traditional scanning services. On-
5 access scanning operates by configuring an operating system (or equivalent control program) to notify the on-access software when a file access attempt is made. For example, file access subroutines of the operating system may be replaced with specialized versions tailored to interact with on-access scanning software. Or, in an event driven environment, the operating system (or equivalent event-control
10 structure) can be instructed to route file access events to the scanning software. In either configuration (or equivalents), file access attempts are effectively intercepted by the scanning software to provide an opportunity to scan the file for viruses before a file requestor obtains access to the file.

15 Unfortunately, there are several problems with on-access scanning. One such problem is the balancing of security needs against causing file-access errors or otherwise overly-delaying access to a file. For security, a file should be scanned before being released to a requestor. Since file access attempts are intercepted, a user requesting the file must therefore wait for scanning to complete before access is
20 granted. If the wait is too long, the user may believe that there has been a software and/or hardware malfunction. Similarly, if the requestor is another program, the program may believe there has been some sort of input/output (I/O) or other error.

To provide an appropriate balance to the foregoing problem, on-access virus
25 scanning techniques have been developed to afford a maximum amount of security while minimizing the amount of system resources used to provide such security. One example of such techniques is to conditionally scan files based on a type of file that is being released to a requestor. It is known that executable files and macro files are more susceptible to virus propagation with respect to data files, e.g. image files,
30 text files, etc. As such, scanners have been configured to allow certain files such as data files to be released with less security measures than executable and macro files.

5

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DISCLOSURE OF THE INVENTION

A system, method and computer program product are provided for efficient on-access computer virus scanning of files. Initially, a process for accessing files is identified. Thereafter, virus detection actions are selected based at least in part on the process. The virus detection actions are then performed on the files.

To this end, varying levels of security may be employed based on the process that is opening the files. This allows for more efficient use of system resources while maintaining an appropriate level of security that suits the current operation of a system.

In one preferred embodiment, the virus detection actions may be selected by determining a category associated with the process. A set of virus detection actions may then be selected based on the determined category. In one aspect of the preferred embodiments, the processes may be identified by inspecting a name of the process, a path of the process, a file signature associated with the process, a version of the process, a manufacturer of the process, a function being called during the process, an owner of the process, a name of an executable file associated with the process, a method in which files are being accessed by the process, type(s) of shared libraries used by the process, and a user of the process.

In addition to selecting the virus detection actions based on the identified process, the files being accessed may be identified themselves for selecting the virus detection actions based at least in part on the identity of the files. As an option, the files may be identified by inspecting a name or extension thereof. This allows the selection of the virus detection actions based on a name of the files, or based on the type(s) of shared libraries used by the identified process.

In the context of one preferred embodiment, the first aspect of the system may include a process adapted for accessing the files, and the second aspect of the system may include a type of the files.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows a representative hardware environment on which processes
5 may be executed to interact with files.

Figure 2 shows steps taken in providing on-access computer virus scanning in an efficient manner in accordance with a preferred embodiment;

Figure 3 shows steps taken in selecting virus detections actions based on a process that is accessing the files; and

Figure 4 shows steps taken in analyzing a process for accessing files to select appropriate virus detection actions.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Computer systems include hardware and software for storing files and
5 executing processes that interact with the files during use. Such processes often
interact with the files in different ways depending on the ultimate goal at hand. For
example, the files may be merely organized by a first process, and actually opened
by another. Further, certain processes may be dedicated to accessing files from
certain sources, such as the Internet. Since virus propagation is often dependent on
10 the extent to which the file is accessed, the source of the file, and other factors and
aspects associated with accessing the file, it is apparent that different levels of
security are necessary.

Figure 1 shows a representative hardware environment on which processes
15 may be executed to interact with files. Such figure illustrates a typical hardware
configuration of a workstation in accordance with a preferred embodiment having a
central processing unit 110, such as a microprocessor, and a number of other units
interconnected via a system bus 112. The workstation shown in Figure 1 includes a
Random Access Memory (RAM) 114, Read Only Memory (ROM) 116, an I/O
20 adapter 118 for connecting peripheral devices such as disk storage units 120 to the
bus 112, a user interface adapter 122 for connecting a keyboard 124, a mouse 126, a
speaker 128, a microphone 132, and/or other user interface devices such as a touch
screen (not shown) to the bus 112, communication adapter 134 for connecting the
workstation to a communication network 135 (e.g., a data processing network) and a
25 display adapter 136 for connecting the bus 112 to a display device 138.

The workstation may have resident thereon an operating system such as the
Microsoft Windows NT or Windows/95 Operating System (OS), the IBM OS/2
operating system, the MAC OS, or UNIX operating system. It will be appreciated
30 that a preferred embodiment may also be implemented on platforms and operating
systems other than those mentioned. A preferred embodiment may be written using

JAVA, C, and/or C++ language, or other programming languages, along with an object oriented programming methodology. Object oriented programming (OOP) has become increasingly used to develop complex applications.

5 Figure 2 illustrates a method 200 of providing on-access computer virus scanning in an efficient manner in accordance with a preferred embodiment. In operation 202, an indication is first received that a file is being accessed by a process. This may be accomplished by intercepting a file call command, or by any other technique known in the art.

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 Next, in operation 204, a process that is being used for accessing files is identified. It should be noted that the process may be associated with an executable file or application. The identity of such process is thus readably ascertainable by an operating system of the hardware environment by inspecting a name or extension of
15 the associated executed file, or by any other known technique. In the present description, it should be understood that the phrase accessing files may refer to various functions each subjecting the operating system to varying degrees of vulnerability to virus, attacks, etc. Just by way of example, such accessing may include opening the files, reading the files, executing the files, indexing the files,
20 organizing the files, editing the files, moving the files, or any other function that involves the files.

 Thereafter, in operation 206, virus detection actions are selected based at least in part on the process. More information will be set forth regarding operation
25 206 of Figure 2 during reference to Figure 3. The virus detection actions are then performed on the files being accessed. Note operation 208. To this end, varying levels of security may be employed based on the process that is accessing the files. This allows for more efficient use of system resources while maintaining an appropriate level of security that suits the functions being carried out by the
30 processes currently being executed by the system.

Figure 3 is a flowchart illustrating a method **300** for selecting virus detections actions based on the process that is accessing the files in accordance with operation **206** of Figure 2. It is first determined in operation **302** whether the process identified in operation **204** of Figure 2 has an identifier associated with it. It should be noted that when a process is first encountered, an identifier may not yet be assigned.

If this is the case, the process is analyzed for selecting the virus detection actions, as indicated in operation **304**. More information will be set forth regarding operation **304** of Figure 3 during reference to Figure 4. Thereafter, an identifier is assigned to the process in operation **306**. Such identifier may be used to indicate the selected virus detection actions. In a preferred embodiment, the identifier may be generated when the process is first executed by an application running the process.

The assignment of the identifier allows the accelerated selection of the virus detection actions when files are repeatedly accessed by the process. This is apparent after decision **302** when it is determined that the process does indeed have an identifier. As shown in Figure 3, the virus detection actions are simply looked up based on the identifier. Note operation **308**.

In decision **310**, it is decided whether the identifier should be cleared. This decision may be conditioned upon the occurrence of a predetermined event, such as the termination of an application. If, in the present example, a currently run application is terminated, the identifier associated with a process of the application may be cleared in operation **312**. Accordingly, the identifier may be reused for different processes.

Figure 4 is a flowchart illustrating a method **400** in which the processes are analyzed for selecting the virus detection actions in accordance with operation **304** of Figure 3. As shown, the virus detection actions may be selected by determining a

5 In order to facilitate the selection of the appropriate virus detection actions, each process may have an associated access risk level identifier associated therewith. In such preferred embodiment, a set of virus detection actions may then be selected based on the category to which the risk level identifier corresponds. In particular, a first, second, third, and fourth set of virus detection actions may be selected in
10 operations 404, 406, 408, and 410, respectively.

In addition to selecting the virus detection actions based on the identified
25 process, the files being accessed may be identified themselves. The virus detection
actions may thus be selected based at least in part on the identity of the files. See
operation 412. The identity of the files may be determined based on various factors
such as the name, path, extension, and/or type of the file. In operation, more security
measures may be executed for certain types of files which are more likely to
30 propagate virus, e.g. executable files, macro files, etc., and less security measures

may be executed for types of files which are less likely to propagate virus, e.g. data files, image files, etc.

A specific example will now be set forth for illustrating one possible
5 implementation of a preferred embodiment. As set forth earlier, some processes
open a large amount of files which may not need to be scanned securely because
there is no risk of a virus propagating. An example of such a scenario on a
Windows® platform would be the known executable file FindFast.exe. FindFast.exe
is a component of Microsoft® Office® that often runs in the background, and opens
10 all the files on a disk in order to construct an index. Because FindFast.exe is
continuously opening files which are instantly scanned by an on-access scanner
program, it can use significant system resources. This is often done in vain since
FindFast.exe is not accessing the files, or the macros therein, in such a way that they
are a risk from a virus propagation point of view.

15 A converse situation involves processes that open a small amount files which
need to be scanned very well because they are being opened in such a way that
viruses could propagate. For instance, on the Windows® platform, WinWord.exe
from Microsoft® Office® accesses Word® documents such that they are opened, and
20 associated macros are executed. Further, Explorer.exe and IExplore.exe are used to
download files from the Internet, a known source of viruses.

In accordance with a preferred embodiment, the common global or default
configuration for the on-access scanner may be supplemented by a separate defined
25 set of categories that apply to certain processes. Upon the appropriate category
being found for a process, specifically tailored virus detection actions may be
executed. Table 1 illustrates the predetermined categories, the exemplary processes
that may fall within the categories, the virus detection actions associated with each
of the categories, and the file types along with the refined subset of virus detection
30 actions in accordance with the present example.

Table 1

Category	Exemplary Processes	Process-based Virus Detection Actions	File Types	File type-based Virus Detection Actions
First	Explorer.exe, Iexplore.exe	1) Scan all files 2) Use macro and program heuristics	.jpg	predetermined virus detection action (VDA)
			.exe	predetermined VDA
			.dll	predetermined VDA
Second	WinWord.exe	1) Scan only files with a recognized extension 2) Check all files for macros 3) Use Macro heuristics	.jpg	predetermined VDA
			.exe	predetermined VDA
			.dll	predetermined VDA
Third	FindFast.exe	Do not scan any file	.jpg	predetermined VDA
			.exe	predetermined VDA
			.dll	predetermined VDA
Fourth	Default	Scan only files with a recognized filename extension	.jpg	predetermined VDA
			.exe	predetermined VDA
			.dll	predetermined VDA

5

In accordance with the principles of Figure 4, Table 1 illustrates that the processes associated with Explorer.exe and Iexplore.exe may be put in a first category. Further, the first set of virus detection actions may be defined as including the steps of scanning all files, and using macro and program heuristics. Further, the processes associated with WinWord.exe may be placed in a second category. The second set of virus detection actions may then be defined as including the steps of

scanning only files with a recognized extension, checking all files for macros, and using macro heuristics.

5 Still yet, the processes associated with FindFast.exe may be placed in a third category, and the third set of virus detection actions may be defined as including the step of not scanning any file. A fourth default category may also be defined for encompassing all processes not already accounted for. In such case, the fourth set of virus detection actions may be defined as including the step of scanning only files with a recognized filename extension.

10

The first and second categories thus ensure that security is heightened in those cases where it is needed. Further, the third and fourth categories prevent on-access scanning of too many files and interfering with the users of the system. The present example of categories is thus particularly useful when utilized in conjunction with a Microsoft® Terminal Server that supports many users who are running processes on the local system.

15

It should be noted that the number of categories need not be set at four, and may include more or less based on the desires of the user. For example, yet another category may be defined for processes that load Wsock32.dll. Such category may have a set of virus detection actions including the steps of scanning all files, and using macro and program heuristics. Monitoring a particular library such as Wsock32.dll may be beneficial in identifying a process that requires a higher level of security with regard to scanning its file accesses.

20

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Specifically, many applications that can download files from the Internet use the "winsock" library (implemented in WSocket32.dll on Windows® NT). Accordingly, a process that loads this library is a potential source of infected files. Thus, the foregoing technique is particularly beneficial since it allows the system administrator to ensure that users are prevented from downloading infected files

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from the Internet whether they are using Internet Explorer[®], Netscape[®] or some other application that is not commonly known.

As shown in Table 1, the virus detection actions may also be refined based on the type of files being accessed. In particular, additional or specifically tailored virus detection actions may be executed which are consistent and in compliance with the virus detection actions selected based on the process. For example, if the process dictates that no virus detection actions are permitted, no virus detection actions may be executed based on the file type.

10

While only .jpg, .exe, and .dll file types are shown, it should be understood that any number of files of any type may be included per the desires of the user. For each of the categories, the different types of files may warrant different predetermined virus detection actions. For example, scanning of .exe file types may include a comprehensive set of actions including heuristic algorithms, signature scanning, etc., and a .jpg file type may include a simple set of actions including just signature scanning, if any actions at all. These actions may vary from category to category.

20

A two-tier indexing system is thus afforded for providing an optimal balance between security and efficient use of system resources. In one aspect of the preferred embodiments, a first aspect of a system is initially identified. Next, a second aspect of the system is identified. Virus detection actions are then selected based at least in part on the first aspect of the system and at least in part on the second aspect of the system. Thereafter, the virus detection actions are performed on the files.

25

In the context of the preferred embodiment set forth hereinabove, the first aspect of the system may include a process adapted for accessing the files, and the second aspect of the system may include a type of the files. It should be understood, however, that the various aspects of the system may relate to any feature or

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parameter of the system that, when changed, may effect a change in the likelihood of virus propagation.

While various embodiments have been described above, it should be
5 understood that they have been presented by way of example only, and not
limitation. Thus, the breadth and scope of a preferred embodiment should not be
limited by any of the above-described exemplary embodiments, but should be
defined only in accordance with the following claims and their equivalents.

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CLAIMS

What is claimed is:

- 1 1. A method for on-access computer virus scanning of files in an efficient
2 manner, comprising the steps of:
3 (a) identifying a process for accessing files;
4 (b) selecting virus detection actions based at least in part on the process; and
5 (c) performing the virus detection actions on the files.
- 1 2. The method as recited in claim 1, wherein the process is carried out by an
2 executable file.
- 1 3. The method as recited in claim 1, wherein the virus detection actions are
2 selected by determining a category associated with the process, and selecting
3 a set of virus detection actions based on the determined category.
- 1 4. The method as recited in claim 1, and further comprising the steps of
2 identifying the files being accessed, and selecting the virus detection actions
3 based at least in part on the identity of the files.
- 1 5. The method as recited in claim 1, wherein the process is identified by
2 inspecting at least one of a name of the process, a path of the process, a file
3 signature associated with the process, a version of the process, a
4 manufacturer of the process, a function being called during the process, an
5 owner of the process, a name of an executable file associated with the
6 process, a method in which files are being accessed by the process, type(s) of
7 shared libraries used by the identified process, and a user of the process.

- 1 6. The method as recited in claim 1, wherein no virus detection actions are
2 selected upon the identification of a predetermined process.
- 1 7. A computer program product for on-access computer virus scanning of files
2 in an efficient manner, comprising:
3 (a) computer code for identifying a process for accessing files;
4 (b) computer code for selecting virus detection actions based at least in part on
5 the process; and
6 (c) computer code for performing the virus detection actions on the files.
- 1 8. The computer program product as recited in claim 7, wherein the process is
2 carried out by an executable file.
- 1 9. The computer program product as recited in claim 7, wherein the virus
2 detection actions are selected by determining a category associated with the
3 process, and selecting a set of virus detection actions based on the
4 determined category.
- 1 10. The computer program product as recited in claim 7, and further comprising
2 computer code for identifying the files being accessed, and selecting the virus
3 detection actions based at least in part on the identity of the files.
- 1 11. The computer program product as recited in claim 7, wherein the process is
2 identified by inspecting at least one of a name of the process, a path of the
3 process, a file signature associated with the process, a version of the process,
4 a manufacturer of the process, a function being called during the process, an
5 owner of the process, a name of an executable file associated with the
6 process, a method in which files are being accessed by the process, type(s) of
7 shared libraries used by the process, and a user of the process.

1 12. The computer program product as recited in claim 7, wherein no virus
2 detection actions are selected upon the identification of a predetermined
3 process.

1 13. A system for on-access computer virus scanning of files in an efficient
2 manner, comprising:

- 3 (a) logic for identifying a process for accessing files;
4 (b) logic for selecting virus detection actions based at least in part on the
5 process; and
6 (c) logic for performing the virus detection actions on the files.

1 14. The system as recited in claim 13, wherein the process is carried out by an
2 executable file.

1 15. The system as recited in claim 13, wherein the virus detection actions are
2 selected by determining a category associated with the process, and selecting
3 a set of virus detection actions based on the determined category.

1 16. The system as recited in claim 13, and further comprising logic for
2 identifying the files being accessed, and selecting the virus detection actions
3 based at least in part on the identity of the files.

1 17. The system as recited in claim 13, wherein the process is identified by
2 inspecting at least one of a name of the process, a path of the process, a file
3 signature associated with the process, a version of the process, a
4 manufacturer of the process, a function being called during the process, an
5 owner of the process, a name of an executable file associated with the
6 process, a method in which files are being accessed by the process, type(s) of
7 shared libraries used by the process, and a user of the process.

1 19. A method for on-access computer virus scanning of files of a system in an
2 efficient manner, comprising the steps of:

- 1 20. The method as recited in claim 19, wherein the first aspect of the system
2 includes a process adapted for accessing the files, and the second aspect of
3 the system includes a type of the files.

- NAI1P004/00.006.01

ABSTRACT

NAI1P004/00.006.01



FIGURE 4

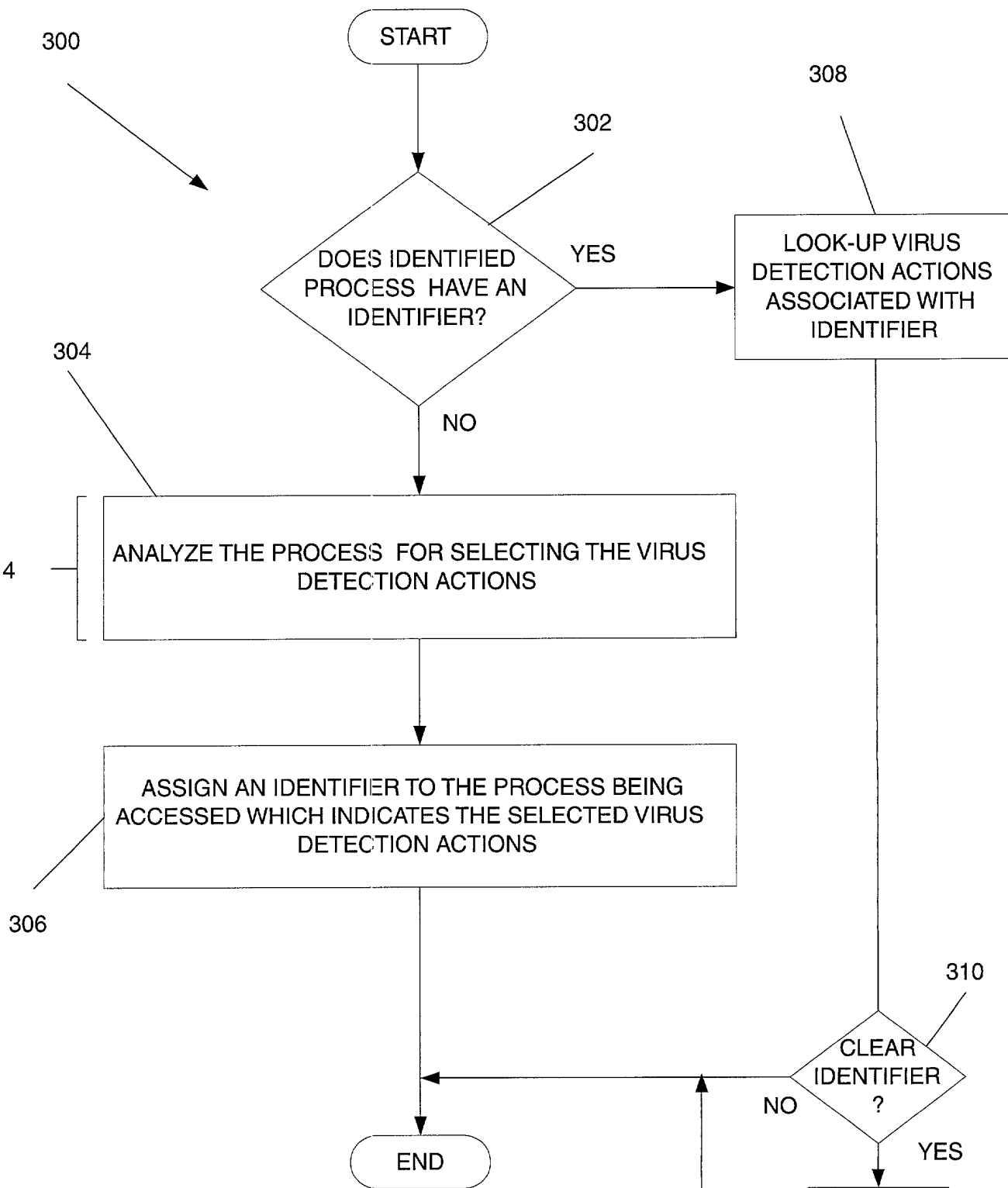
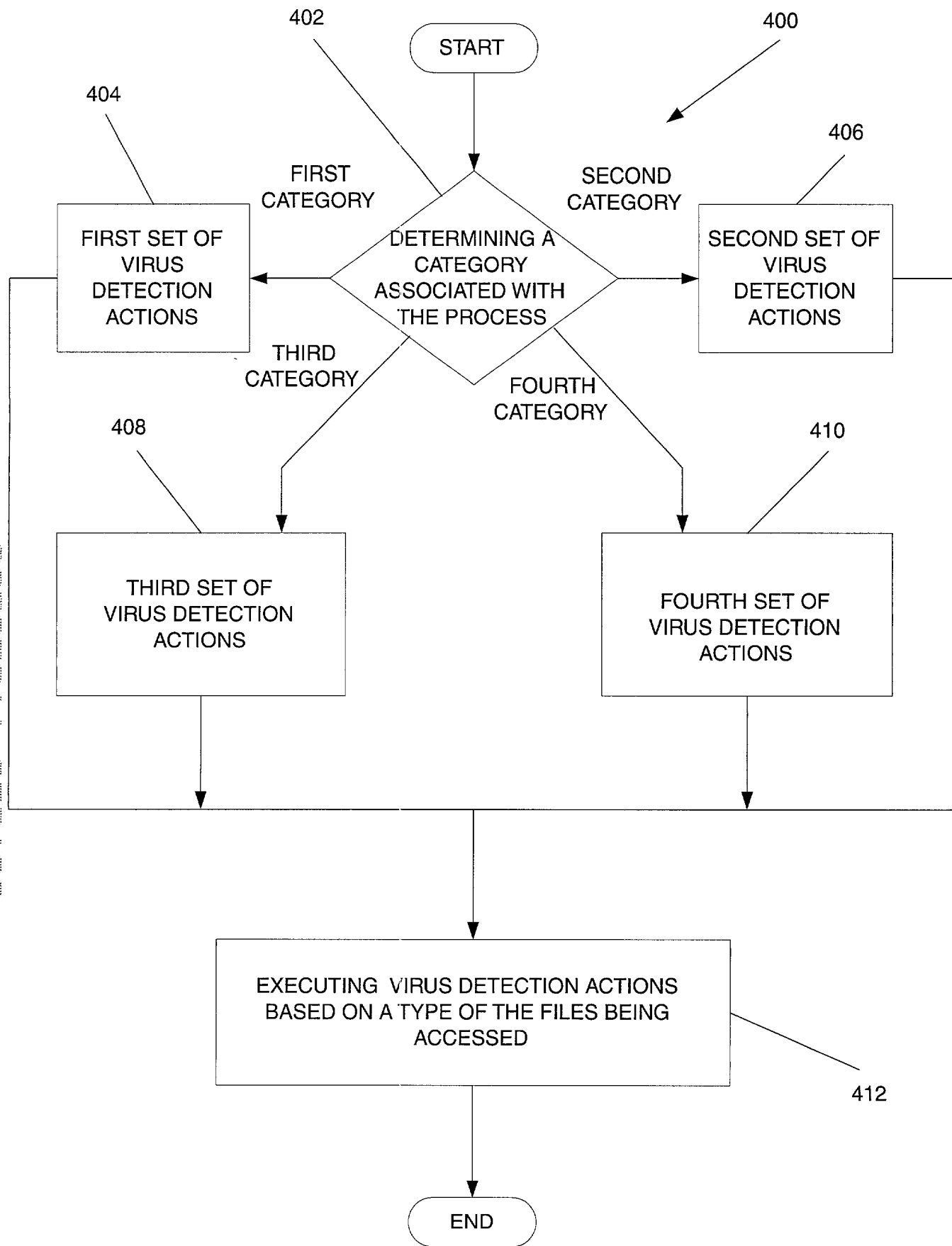


FIGURE 3



DECLARATION AND POWER OF ATTORNEY FOR ORIGINAL U.S. PATENT APPLICATION

Docket No. NAI1P004/00.006.01

As a below-named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe that I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled: **System, Method and Computer Program Product for Process-Based Selection of Virus Detection Actions**, the specification of which.

- (check one)
1. ☒ is attached hereto.
2. ☐ was filed on _____ as
U.S. Application Serial No. _____
and was amended on _____.
3. ☐ was filed on _____ as
International PCT Application Serial No. _____
and was amended on _____.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, CFR § 1.56.

I hereby claim foreign priority benefits under Title 35, United States code, § 119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s)

Priority Benefits Claimed?

_____ (Appl. No.)	_____ (Country)	_____ (Filing Date)	<input type="checkbox"/> Yes <input type="checkbox"/> No
_____ (Appl. No.)	_____ (Country)	_____ (Filing Date)	<input type="checkbox"/> Yes <input type="checkbox"/> No
_____ (Appl. No.)	_____ (Country)	_____ (Filing Date)	<input type="checkbox"/> Yes <input type="checkbox"/> No

I hereby claim the benefit under 35 U.S.C. §119(e) of any United States provisional application(s) listed below:

(Application Serial No.)	(Filing Date)
(Application Serial No.)	(Filing Date)

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s), or § 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

Prior U.S. Application(s)

_____ (Application Serial No.)	_____ (Filing Date)	_____ (Status - patented, pending, abandoned)
_____ (Application Serial No.)	_____ (Filing Date)	_____ (Status - patented, pending, abandoned)

And I hereby appoint the following patent attorney/agents, including **Kevin J. Zilka (Reg. No. 41,429)**; and **Brian J. Daiuto (Reg. No. 38,422)** as my principal attorneys to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

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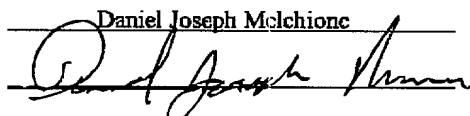
I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

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001650 "T" 853560